Information Assurance/Cyber Security

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1.1   Overview

The Regional Economic Studies Institute (RESI) of Towson University used existing information regarding the information assurance (IA) industry to conduct a comparative analysis of St. Mary's County and other previously identified counties nationwide from 2005 to 2014. Through analyzing this comparison, RESI aimed to highlight areas where St. Mary's County has a competitive advantage within the IA industry.

1.2   Summary of Findings

Below are RESI's key findings in regard to the St. Mary's County's comparative advantage in the IA industry and the economic impacts of IA in Maryland.

Comparative Advantage

- According to the Quarterly Census of Employment and Wages (QCEW), the IA industry in St. Mary's County has seen growth on all counts from 2005 to 2014. In 2005, St. Mary's County had a total of 54 IA establishments employing approximately 1,800 individuals, and the average weekly wage for individuals in the IA industry was approximately $1,300. Moreover, the average annual wage associated with the IA industry within St. Mary's County was approximately $70,000 in 2005—this was significantly higher than the countywide average annual wage of $46,012 for all industries in 2005.
  - Between 2005 and 2014, St. Mary's County has seen a 57 percent increase in the number of IA related establishments.
  - Between 2005 and 2014, St. Mary's County has seen a 9 percent increase in the number of employees in IA related establishments.
  - Between 2005 and 2014, St. Mary's County has seen a 40 percent increase in both the average weekly wages and the average annual wage in IA related establishments.
- According to QCEW data, the IA industry in St. Mary's County had a total of 85 IA establishments employing approximately 2,000 individuals, and the average weekly wage for individuals in the IA industry was approximately $1,900 in 2014. Moreover, the average annual wage associated with the IA industry within St. Mary's County was approximately $98,000 in 2014—this was significantly higher than the countywide average annual wage of $63,320 for all industries in 2014.

Economic Impacts

- In 2015, the IA industry generated an estimated 3,800 jobs, $527.9 million in output, and nearly $235.3 million in wages.
- The total fiscal impacts associated with the IA industry in St. Mary's County amount to $10.3 million to state and local tax revenues annually.

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2.0   Introduction

The Regional Economic Studies Institute (RESI) of Towson University used existing information regarding the information assurance (IA) industry to conduct a comparative analysis of St. Mary's County and other previously identified counties nationwide from 2005 to 2014. Through this comparative analysis, RESI aimed to highlight areas where St. Mary's County has a competitive advantage within the IA industry.

IA is vital to a multitude of industries—military and civilian alike. If the government systems were compromised through security vulnerabilities, the results could cause severe economic damage or loss of life.[1] Therefore, the federal government sector continues to see increased investments in cyber security technologies despite the "bleak budgetary environment."[2] While defense and, in the past, the banking industries invested the heaviest in protecting information, it may now be time for retailers to do the same.[3] Nationwide retailers such as Home Depot, Target, and Barnes & Noble have all experienced recent security breaches resulting in credit and debit card data theft.[4] These attacks come at the same time as cyber-attacks on JPMorgan Chase & Co., the country's largest bank, and Virginia-based U.S. Investigations Services, a background check provider for government employees.[5] Consequently, the growing security risks of the modern world have generated vast investment opportunities in cyber security.[6] As a result of increased data breaches and security threats, the Obama administration announced a newly tasked cyber security threat response agency in February 2015.[7] The newly formed Cyber Threat Intelligence Integration Center will rely on the private sector and other outside assistance.[8]

Given St. Mary's County's highly skilled workforce and government resources, the county is poised to respond to growing IA demands. This report continues as follows: Section 3.0 defines the IA industry using North American Industry Classification System (NAICS) codes; Section 4.0 describes the IA industry within St. Mary's County, followed by a national comparison of the IA

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[1] Jose Campos, "The Importance of Information Assurance: Protecting against foreign entity cyber attacks," May 20, 2010, accessed September 29, 2014, http://www.army.mil/article/39550/the-importance-of-information-assurance-protecting-against-foreign-entity-cyber-attacks/.

[2] "U.S. Federal Cybersecurity Market Forecast 2015-2020," Market Research Media, accessed November 25, 2014, http://www.marketresearchmedia.com/?p=206.

[3] Zacks.com,"Data Breach Specter: 3 Cyber Security Stocks to Benefit," NASDAQ, September 04, 2014, accessed September 29, 2014, http://www.nasdaq.com/article/data-breach-specter-3-cyber-security-stocks-to-benefit-analyst-blog-cm386938.

[4] Ibid.

[5] Ibid.

[6] Ibid.

[7] Tom Risen, "New Agency to Aid in Battle Against Hackers," US News, February 10, 2015, accessed September 8, 2015, http://www.usnews.com/news/articles/2015/02/10/new-cybersecurity-agency-to-aid-in-battle-against-hackers.

[8] Ibid.

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industry in Section 5.0; and Section 6.0 reports the economic and fiscal impacts associated with the IA industry in St. Mary's County as determined in RESI's analysis.

3.0   Information Assurance

In the United States, IA is defined as "measures that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation."[9] Cyber security, also known as information technology security, aims to shield computers, data, and networks from unauthorized access, use, and damage—cyber security is an important piece of the IA industry.[10] To protect the various assets of entities such as the Department of Defense (DoD), one must first understand the vulnerabilities of information systems. To aid in this understanding, Personnel and Readiness Information Management (P&R IM) offers guidance and training in the following areas:

- Department of Defense Information Assurance Certification and Accreditation Program (DIACAP);
- Employee awareness education covering
   - IA principles,
   - Information security weaknesses and threats, and
   - Information handling, storage, and protection;
- Information Assurance Vulnerability Management (IAVM); and
- Privacy Impact Assessments (PIAs).[11]

According to the Information Assurance Directorate, the top ten technology challenges of 2014 include but are not limited to automated risk detection and mitigation, cloud security and storage, and engineering and operating secure composite systems.[12] To reduce these security risks, the United States Defense Department is committed to the use of and improvement of cloud-based technology.[13] On August 26, 2015, the DoD released interim standards and reporting requirements regarding cybersecurity and cloud standards—one requirement deems that all cloud controls and safeguards meet those standards specified in the Cloud Computing

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[9] Colonel Gene Tyler, "U.S. Department of Defense Information Assurance," page 2, Department of Defense, accessed September 29, 2014,
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=8&cad=rja&uact=8&ved=0CG0QFjAH&url=http%3A%2F%2Fwww.cybersecuritycooperation.org%2Fpresentations%2FCol%2520Tyler%2FDOD%2520IA%2520Brief.ppt&ei=GaoJVLqZDMLlsATZsIHICA&usg=AFQjCNH6_s9W6Q60U7AqCTyGHpV-zkNsVg&sig2=uH5-bkmXUTOOKjIq9yw2Qg .

[10] "Cyber Security," University of Maryland University College, accessed September 24, 2015, http://www.umuc.edu/cybersecurity/about/cybersecurity-basics.cfm.

[11] Personnel and Readiness Information Management, "Information Assurance," Department of Defense, accessed November 25, 2014, http://www.prim.osd.mil/cap/cio-ia.html?p=1.1.1.1.

[12] "IA News," National Security Agency and Central Security Service, January 15, 2009, accessed November 25, 2014, https://www.nsa.gov/ia/news/index.shtml.

[13] John K. Higgins, "DoD Ramps up Security as it Drifts Toward Cloud," *Tech News World,* September 19, 2014, accessed September 30, 2014, http://www.technewsworld.com/story/81035.html.

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Security Requirements Guide.[14] Opponents state that public clouds lack the robust security of a local IT infrastructure, but organizations like IBM are working to alleviate such concerns. IBM has announced plans to add Intel chip technology to the existing cloud platform, therefore increasing the security of the cloud.[15]

The United States appears to be especially at risk, and is said to have the largest share of cyber security spending worldwide.[16] Symantec Corporation, an internet security firm, revealed that U.S.-based business cyber-attacks increased 91 percent from 2012 to 2013.[17] Given the prevalence of recent security breaches, it is no surprise that cyber-security technology has increased in market size.[18] Bloomberg Intelligence data estimates that corporate spending on security will increase to $1.4 billion by 2018.[19] While the market may be growing, attendees of August 2014's Black Hat USA conference announced that the number of available cybersecurity jobs outweighs individuals qualified to fill them.[20] Universities across the United States, including those in Maryland and Virginia, are aiming to help fill these positions.[21]

In today's technologically advanced world, businesses and consumers have to be proactive in regard to computer security.[22] As hackers aim to steal personal information, identity theft has become a major concern.[23] With unknown risks of technological advancements, such as the connected car, will hold more user information than can be attributed to all mobile device activities combined.[24] Some security vulnerabilities that hackers may exploit include the following:

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[14] Mary Bosco and Norma Krayem, "DoD's New Cybersecurity and Cloud Standards and Reporting Requirements," Holland & Knight, August 28, 2015, accessed September 8, 2015, http://www.hklaw.com/publications/DoDs-New-Cybersecurity-and-Cloud-Standards-and-Reporting-Requirements-08-28-2015/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original.

[15] John P. Mello Jr., "IBM Enlists Intel to Shore up Hybrid Cloud," *Tech News World,* September 10, 2014, accessed September 30, 2014, http://www.technewsworld.com/story/81022.html.

[16] Zacks.com,"Data Breach Specter: 3 Cyber Security Stocks to Benefit."

[17] Idid.

[18] Gabrielle Coppola, "CyberArk IPO Gets a Boost as Breaches Trigger Industry Gain," Bloomberg, September 15, 2014, accessed September 29, 2014, http://www.bloomberg.com/news/2014-09-13/cyberark-ipo-gets-boost-as-breaches-trigger-industry-gain.html.

[19] Ibid.

[20] Violet Blue, "Cybersecurity's Hiring Crisis: A Troubling Trajectory," ZDNet, August 25, 2014, accessed September 29, 2014, http://www.zdnet.com/cybersecuritys-hiring-crisis-a-troubling-trajectory-7000032923/.

[21] "Top 10 Universities for Cybersecurity," DSST, last modified February 22, 2014, http://getcollegecredit.com/blog/article/top_10_universities_for_cybersecurity.

[22] "Information Assurance and Cyber Security Concentration," University of Wisconsin STOUT, accessed September 29, 2014, http://www.uwstout.edu/programs/bsamcs/conc-iacs.cfm.

[23] Ibid.

[24] Jack M. Germain, "The Connected Car, Part 3: No Shortcuts to Security," Tech News World, August 19, 2014, accessed September 30, 2014, http://www.technewsworld.com/story/80918.html.

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- "Social Engineering attacks where a user is "tricked" into disclosing important personal or sensitive information such as passwords to a source that they believe to be legitimate;
- Distributed Denial of Service (DDoS) attacks where a network is overwhelmed and basically paralyzed; and
- Malware, such as viruses, Trojans, and worms, designed with the intent to infiltrate, damage or destroy a system."[25]

Related industry NAICS codes primarily falling under the four-digit code 5415 (Computer Systems Design and Related Services) and five-digit code 54151 (Computer Systems Design and Related Services) include but are not limited to the following:

- 541511: Custom Computer Programming Services,
- 541512: Computer Systems Design Services,
- 541513: Computer Facilities Management Services, and
- 541519: Other Computer Related Services.[26]

4.0 Industry in St. Mary's County

Maryland is home to an array of assets, including the U.S. Cyber Command, the Defense Information School, the Defense Information Systems Agency, and the National Security Agency—all housed at Fort George G. Meade.[27] This and other assets provide the state with unique opportunities in regard to IA technology.

4.1 Maryland

Maryland's strong defense presence has allowed for vast development of cybersecurity education and training programs, technology resources, a strong infrastructure, and a large pool of experts—turning the state into a nationally and internationally recognized leader in the industry.[28] Maryland houses 16 National Centers of Academic Excellent in IA and the government agencies located in Maryland employ more mathematicians than any one organization worldwide.[29] In addition, given the military and civilian applications of the technology, collaborative partnerships are increasing. Northrop Grumman Corporation, a proponent of cyber defense through global partnerships, noted that "academic partnerships provide the opportunity to access and co-develop education, research and make investments in

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[25] Campos, "The Importance of Information Assurance: Protecting against foreign entity cyber attacks."

[26] "2012 NAICS Definition, search results for 31," United States Census Bureau, accessed June 12, 2014, https://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart_code=5415&search=2012%20NAICS%20Search.

[27] "About Fort Made," U.S. Army, June 15, 2015, accessed June 18, 2015, http://www.ftmeade.army.mil/pages/about/about.html.

[28] "CyberMaryland 2014," CyberMaryland 2014, accessed September 29, 2014, https://www.fbcinc.com/e/cybermdconference/.

[29] Ibid.

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support of tomorrow's cyber defenders."[30] One such partnership is the University of Maryland Baltimore County's Cync Programme.[31]

In a study prepared by Prager Schneider, Central Maryland was highlighted as one area exhibiting impressive efforts to grow cybersecurity—according to the study, the use of incentives appears to be key.[32] In recognition of the importance and prominence of the IA industry, and the effectiveness of incentives, the federal and state governments alike have provided funding and support to the IA industry in Maryland. In fact, Maryland leads the nation in venture funding of cybersecurity companies, with more than 15 incubators offering support to cyber innovation businesses and over $1.0 billion per year in start-up funding awarded.[33] More recently, in just the first six months of 2014, Maryland companies raised $64 million in venture capital funding—much of which has been contributed to cybersecurity startups in Baltimore City.[34] ZeroFOX and RedOwl raised $10.7 million and $4.6 million, respectively, during the second quarter.[35] Baltimore's Maddrixx LLC is among seven companies to be the first ones accredited in a new National Security Agency vetting program.[36]

In addition to the Maryland Venture Fund, the state also offers the CyberMaryland Fund, the Cybersecurity Investment Tax Credit (CIITC), and other various tax credit programs.[37][38] Through CIITC, qualified cybersecurity companies within Maryland can receive a refundable income tax credit equal to 33 percent of eligible investment in a qualified cybersecurity company.[39] The goal is to encourage the creation or relocation of cybersecurity companies in Maryland and help to maintain Maryland's existing intellectual property.[40] In Montgomery County, qualified

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[30] "Northrop Grumman Calls for Robust Partnerships to Combat Growing Cyber Threat," Northrop Grumman, June 18, 2014, accessed November 25, 2014, http://www.northropgrumman.com/mediaresources/Pages/NewsArticle.aspx?art=http://www.globenewswire.com/newsarchive/noc/press/xml/nitf.html?d=10086305.

[31] Ibid.

[32] Lynn Brezosky, "Study: San Antonio Needs to Step Up Cybersecurity Recruitment," San Antonio Express-News, March 18, 2015, accessed September 8, 2015, http://www.govtech.com/security/Study-San-Antonio-Needs-to-Step-Up-Cybersecurity-Recruitment.html.

[33] "CyberMaryland 2014," CyberMaryland 2014.

[34] Jamie Smith Hopkins, "Cybersecurity Firms among Top Recipients of Venture Funding in Maryland," The Baltimore Sun, July 21, 2014, accessed September 29, 2014, http://www.baltimoresun.com/business/bs-bz-raising-venture-capital-20140721,0,5223453.story.

[35] Ibid.

[36] Scott Dance, "Baltimore Startup Lands on List of NSA Cybersecurity Experts," Government Technology, August 26, 2014, accessed September 29, 2014, http://www.govtech.com/local/Baltimore-Startup-Lands-on-List-of-NSA-Cybersecurity-Experts.html.

[37] "Cybersecurity," Montgomery Economic Development, accessed September 29, 2014, http://www.choosemontgomerymd.com/business-community/industry-sectors/cybersecurity#.VCl7QVdp7zN.

[38] "Cybersecurity Investment Incentive Tax Credit," Maryland Department of Business and Economic Development, accessed September 29, 2014, http://business.maryland.gov/fund/programs-for-businesses/cyber-tax-credit.

[39] Ibid.

[40] Ibid.

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businesses can also benefit from a local supplement to the statewide incentive.[41] Through the county, qualified Montgomery County companies (those that received a tax credit from the State of Maryland) are eligible for a local supplement in the year following receipt of state funding.[42] In 2015 three cybersecurity startups—Protenus, Strajillion, and Ridgeback Network Defense—were the first to receive funding from the new Cybersecurity Investment Fund (through TEDCO).[43] One other, Bricata, a recently relocated firm from Virginia, is potentially slated to receive funding as well—this funding is in addition to the funding already received from the InvestMaryland Challenge.[44]

As Maryland takes advantage of these incentives and continues to grow its IA industry, residents will be presented with an abundance of well-paying career opportunities. According to Burning Glass, a technology-focused recruiting company, there were more than 23,000 cybersecurity jobs postings in the Washington metropolitan region in 2013 (the most of any metropolitan region).[45] The University of Maryland hopes to help fill these positions. The University of Maryland University College is promoted as one of the top ten universities for cybersecurity and was a 2013 finalist for Best Cyber Education Program.[46]

4.2   St. Mary's County

St. Mary's County, located in southern Maryland, has a multitude of resources to enable growth in the IA industry—including Naval Air Station Patuxent River and various DoD contractors. St. Mary's County's 2,000 businesses employ 28,800 workers—of the top ten employers in St. Mary's County, only one (MedStar St. Mary's Hospital) is a non-defense employer.[47]

[41] "Cybersecurity Investment Incentive Tax Credit," Maryland Department of Business and Economic Development.
[42] "Local Cybersecurity Investment Incentive Tax Credit Supplement," Montgomery Economic Development, accessed September 29, 2014, http://www.choosemontgomerymd.com/programs-incentives/financial-tax-incentives/local-cybersecurity-investment-incentive-tax-credit-supplement#.VCnOJvldVyw.
[43] Stephen Babcock, "These 3 cybersecurity startups got money from a new TEDCO fund," Technical.ly, March 19, 2015, accessed September 8, 2015, http://technical.ly/baltimore/2015/03/19/3-cybersecurity-startups-got-money-new-tedco-fund/.
[44] Stephen Babcock, "Why this cybersecurity startup is moving from Virginia to Maryland," Technical.ly, May 21, 2015, accessed September 8, 2015, http://technical.ly/baltimore/2015/05/21/cybersecurity-startup-moving-virginia-maryland/.
[45] Sarah Halzack, "Report Finds D.C. Area a Hotbed for Cybersecurity Jobs," The Washington Post, March 8, 2014, accessed September 29, 2014, http://www.washingtonpost.com/business/capitalbusiness/report-finds-dc-area-a-hotbed-for-cybersecurity-jobs/2014/03/08/1b72ff1e-a560-11e3-8466-d34c451760b9_story.html.
[46] "Top 10 Universities for Cybersecurity," DSST.
[47] ChooseMaryland, "Brief Economic Facts St. Mary's County, Maryland," page 1-2, Department of Business & Economic Development, 2014, accessed November 25, 2014, http://business.maryland.gov/Documents/ResearchDocument/StMarysBef.pdf.

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Figure 1: Top Employers in St. Mary's County

Employer	Product/Service	Employment
Naval Air Station Patuxent River	Military installation	11,232
MedStar St. Mary's Hospital	Medical services	1,201
DynCorp International	Professional and technical services	1,019
BAE Systems	Technical products and services	850
Wyle	Technical research services	705
Lockheed Martin	Aeronautics, systems engineering	540
Engility	Systems engineering and management	500
Boeing	Engineering services	4580
HMR of Maryland/Charlotte Hall	Nursing care	438
SAIC	Engineering and management services	431

Sources: ChooseMaryland; Department of Business and Economic Development

St. Mary's County's largest employer, Naval Air Station Patuxent River, employed approximately 19,000 individuals in fiscal year 2012; of those only 12 percent were military, while 88 percent were civilians and contractors.[48] Computer systems analysts, network administrators, information security analyst, and computer support specialists are among the top paid occupations in St. Mary's County.[49] Numerous defense contractors located in St. Mary's County provide IA services. These contractors include but are not limited to the following:

- American Electronics, Inc.;
- DCS Corporation;
- Fermion Government Services;
- FGS, LLC;
- New Directions Technologies Incorporated;
- PAE Applied Technologies, LLC;
- Spalding Consulting, Inc.;
- SOLUTE Consulting;
- Specialty Systems, Inc.;
- Strategic Systems Technology, Inc.;
- Synergy ECP; LLC;
- System Planning Corporation;
- Technology Security Associates, Inc.; and
- Tekla Research, Inc.[50]

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[48] "Economic Overview," page 29, St. Mary's County Department of Economic & Community Development, accessed November 25, 2014, http://www.co.saint-marys.md.us/docs/document27-economicoverview.pdf.
[49] ChooseMaryland, "Brief Economic Facts St. Mary's County, Maryland," page 2.
[50] St. Mary's County Department of Economic and Community Development and The Board of County Commissioners, "2014-2105 Technology Handbook for St. Mary's County," accessed September 29, 2014, http://www.stmarysmd.com/docs/TechHandbooknoart.pdf.

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St. Mary's County has a number of training opportunities within the business environment—both through contractors and military affiliates.[51] In addition to St. Mary's County's thriving IA business environment, the College of Southern Maryland (CSM) and the Southern Maryland Higher Education Center (SMHEC) are both working to prepare individuals for careers in IA. To increase the number of skilled cybersecurity professionals entering the industry, CSM joined (ISC)[2] in the global academic program to provide students and professionals with the knowledge, skills, and certifications to excel in the IA industry.[52] To help meet the demand for skilled IA professionals, SMHEC now offers a Doctorate in IA from Capital College.[53]

At an estimated 110,382 individuals, St. Mary's County was home to less than 2 percent of Maryland's overall population in 2014.[54] According to the United States Census Bureau, St. Mary's County residents are more likely to hold at least a high school diploma and typically earned a higher household income than the average Maryland resident. In 2014, 90.3 percent of St. Mary's County residents aged 25 years or older have at least a high school diploma, while 29.5 percent hold a bachelor's degree or higher—comparatively, 88.7 percent Maryland residents aged 25 years or older have at least a high school diploma, while 36.8 percent hold a bachelor's degree or higher.[55] The median household income in St. Mary's County is higher than that for Maryland overall—approximately $86,000 in St. Mary's County compared to $74,000 for Maryland overall.[56] Moreover, those employed in the IA industry typically earn wages even greater.

According to the Quarterly Census of Employment Data (QCEW) and the IA industry as defined in Section 3.0, the average annual wage associated with the IA industry within St. Mary's County was approximately $98,000 in 2014—this was significantly higher than the countywide average annual wage of $63,320 for all industries in 2014.[57] The QCEW data, which provide information on establishments and employment nationwide, are based on the Bureau of Labor Statistics' payroll data. For more information on this dataset, please see Section 5.1. According to the QCEW, St. Mary's County had a total of 85 IA establishments employing nearly 2,000 individuals, and the average weekly wage for individuals in the IA industry was approximately

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[51] St. Mary's County Department of Economic and Community Development and The Board of County Commissioners, "2014-2105 Technology Handbook for St. Mary's County."

[52] "CSM Begins Cybersecurity Program," Southern Maryland Newspapers Online, August 29, 2014, accessed September 29, 2014, http://www.somdnews.com/article/20140829/NEWS/140829183/1046/csm-begins-cybersecurity-program&template=southernMaryland.

[53] "Business e-Newsletter," page 4, St. Mary's County Department of Economic and Community Development, December 11, 2009, accessed September 29, 2014, http://www.co.saint-marys.md.us/docs/businessnews12-11-09.pdf.

[54] "St. Mary's County, Maryland QuickFacts," United States Census Bureau, last modified August 5, 2015, http://quickfacts.census.gov/qfd/states/24/24037.html.

[55] Ibid.

[56] Ibid.

[57] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics, accessed September 1, 2015, http://www.bls.gov/cew/.

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$2,000 in 2014.[58] The IA industry in St. Mary's County saw a slight reduction, more than 200 individuals, in employment between 2008 and 2010 (likely due to the 2008 recession), but has since recovered. The IA industry in St. Mary's County has seen growth on all counts since 2005, where St. Mary's County had a total of 54 IA establishments employing approximately 1,800 individuals, and the average weekly wage for individuals in the IA industry was approximately $1,300.[59]

5.0   Industry Nationwide

RESI examined St. Mary's County and four comparable counties (San Diego County, California; Bexar County, Texas; Salt Lake County, Utah; Fairfax County, Virginia) in the United States that have a developed IA industry.

5.1   Comparative Analysis

The comparative analysis entails the comparison of each region based on indicators such as the following:
- Industry specific data (employment, number of establishments, wages, etc.) and
- Demographic and workforce characteristics of the region, such as
  - Population (including age and educational attainment breakdowns where possible),
  - Employment status, and
  - Median household income.

To complete this comparison, RESI utilized QCEW data to compare the activity within St. Mary's County, Maryland, and the four other identified counties. The following section will review the IA industry in Maryland. RESI used QCEW data, which reports at the establishment level, as its main source. An **establishment**, as defined by the Census and Bureau of Labor Statistics, is "a business or industrial unit at a single location that distributes goods or performs services."[60]

QCEW data are based on Bureau of Labor Statistics (BLS) payroll data that are self-disclosed by the establishments.[61] The information provided in the QCEW data includes employment, wages, average annual wages, number of establishments, and average weekly wages. While this is a valuable source of information given its reliability, accuracy, and recent collection, it has three limitations, as detailed below.
1. Small establishments with fewer than five employees may be underrepresented in the data due to concerns over disclosing their data to competitors.[62]

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[58] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.
[59] Ibid.
[60] "Quarterly Census of Employment and Wages Frequently Asked Questions," U.S. Bureau of Labor Statistics, last modified September 18, 2014, accessed September 1, 2015, http://www.bls.gov/cew/cewfaq.htm#Q20.
[61] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.
[62] Ibid.

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2. Establishments that only consist of the owner as the single employee will not be counted since these establishments do not pay unemployment insurance benefits and are considered "non-employer establishments."[63]
3. In cases where any single establishment may be identified using the information, the data provided by QCEW may be non-disclosed.[64]

Therefore, if fewer than three establishments are in a six–digit NAICS code, it would be easy to determine the size of a competitor and would increase the chances of non-disclosure. An alternative option for establishments in this situation is to report their NAICS code at the four-digit level instead of at the six-digit level. In addition, QCEW provides a quarterly assessment of economic activity across the industry, including total wages and average weekly wages. Using this dataset, St. Mary's IA industry was reviewed and compared to four other counties outside Maryland in this section.

5.1.1 San Diego County, California

Through San Diego's diversity and military expertise, the region aims to become a cyber security technology stronghold.[65][66] The cybersecurity industry in San Diego is anchored by Space & Naval Warfare Systems Command (SPAWAR) as well as the more than 100 core cyber firms located in the region.[67] In total regional firms, SPAWAR and the core cyber firms generate $1.5 billion in economic impact and employ nearly 7,000 individuals.[68] SPAWAR alone generates more than $700 million in economic impact and employs more than 6,000 individuals.[69] Employment within San Diego cybersecurity firms is estimated to grow by 13 percent between 2013 and 2014—a growth rate far above San Diego's average for total employment growth, 2.2 percent.[70] San Diego's universities have partnered with the Cyber Center of Excellence with the goal of attracting and training entry- to mid-level personnel.[71]

In July 2015, it was announced that the University of San Diego was to begin offering degrees and certifications in cyber security.[72] The following month, in August 2015, Governor Jerry

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[63] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[64] Ibid.

[65] "Cyber Security is San Diego's Next Frontier in Rapid Job Growth," ESET, last modified March 20, 2014, http://www.eset.com/us/presscenter/press-releases/article/cyber-security-is-san-diegos-next-frontier-in-rapid-job-growth/.

[66] Mike Freeman, "SD Aims to build Cyber Security Cluster," U~T San Diego, March 20, 2014, accessed September 30, 2014, http://www.utsandiego.com/news/2014/mar/20/Cafferty-SPAWAR-Issa-Peters-cyber-security/.

[67] "Cyber Security is San Diego's Next Frontier in Rapid Job Growth," ESET.

[68] Ibid.

[69] Ibid.

[70] Ibid.

[71] Ibid.

[72] Gary Warth, "USD to open cyber-security center," the San Diego Tribune, July 7, 2015, accessed September 8, 2015, http://www.sandiegouniontribune.com/news/2015/jul/07/usd-to-open-cyber-security-center/.

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Brown announced the implementation of increased cybersecurity protection measures with the creation of the California Cybersecurity Integration Center.[73]

In 2014, San Diego's estimated population approached 3.3 million, or approximately 8 percent of California's total population. According to the United States Census Bureau, San Diego County residents are more likely to hold a bachelor's degree of higher and typically earned a higher household income than the average California resident. For individuals 25 years and older, 85.5 percent hold at least a high school diploma while 34.6 percent hold a bachelor's degree or higher—comparatively, 81.2 percent California residents aged 25 years or older have at least a high school diploma, while 30.7 percent hold a bachelor's degree or higher.[74] The median household income of San Diego residents is approximately $63,000, compared to $61,000 for all California residents.[75] Those employed in the IA industry typically earn more than the average San Diego County resident.

According to QCEW data and the IA industry as defined in Section 3.0, the average annual wage associated with the IA industry within San Diego County was approximately $104,000 in 2014—this was significantly higher than the countywide average annual wage of $56,561 for all industries in 2014.[76] In 2014, San Diego County had a total of 1,900 IA establishments employing more than 18,000 individuals, and the average weekly wage for individuals in the IA industry approached $2,000.[77] The IA industry in San Diego County was not notably impacted by the 2008 recession and has seen growth on all counts since 2005 where San Diego County has a total of 1,600 IA establishments employing approximately 14,000 individuals, and the average weekly wage for individuals in the IA industry was approximately $2,400.[78]

5.1.2   Bexar County, Texas

San Antonio is home to a growing number of cybersecurity spinout firms (such as SecureLogix and Globalscape).[79] San Antonio hosts an estimated 80 cybersecurity companies.[80] San Antonio has a strong information technology and defense base as well as a multitude of technology

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[73] Eyragon Eidam, "California, Virginia Take Steps to Bolster Cybersecurity Stance," Government Technology, September 1, 2015, accessed September 8, 2015, http://www.govtech.com/state/California-Virginia-Take-Steps-to-Bolster-Cybersecurity-Stance.html.

[74] "San Diego County, California QuickFacts," United States Census Bureau, last modified August 5, 2015, http://quickfacts.census.gov/qfd/states/06/06073.html.

[75] Ibid.

[76] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[77] Ibid.

[78] Ibid.

[79] Mike W. Thomas, "Securing our Cyber Status," San Antonio Business Journal, May 16, 2014, accessed September 30, 2014, http://www.bizjournals.com/sanantonio/print-edition/2014/05/16/securing-our-cyber-status.html?page=all.

[80] Lalorek, "Cybersecurity Firm root9b Expands to San Antonio," Silicon Hills, August 14, 2015, accessed September 8, 2015, http://www.siliconhillsnews.com/2015/08/14/cybersecurity-firm-root9b-expands-to-san-antonio/.

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research institutions.[81] Texas boasts nearly 3,000 certified information systems security professionals, while the San Antonio region alone has more than 400.[82]

In the hope of increasing the number of individuals joining the IA industry, the University of Texas at San Antonio—DSST, formerly known as the DoD's Defense Activity for Non-Traditional Education Support (DANTES), lists the University of Texas at San Antonio as one of the top ten universities for cybersecurity—Southern Methodist University, and St. Mary's University have begun providing more courses in information technology and cybersecurity.[83] [84] [85] Beginning with the fall 2015 semester, St. Mary's University will officially offer new Masters of Science degree in cybersecurity.[86] Southern Methodist University is one of 44 National Centers of Academic Excellence in Information Assurance/Cyber Defense designated institutions. [87] In a survey sponsored by Hewlett-Packard, the undergraduate and graduate programs at University of Texas at San Antonio received the highest rankings for practical relevance and academic excellence.[88]

With nearly 1.9 million individuals in 2014, Bexar County was home to nearly 7 percent of Texas's total population. According to the United States Census Bureau, Bexar County residents were on par with the average Texas resident in terms of education and median household income. For individuals 25 years and older, 82.6 percent hold at least a high school diploma while 26.3 percent hold a bachelor's degree or higher—comparatively, 81.2 percent Texas residents aged 25 years or older have at least a high school diploma while 26.3 percent hold a bachelor's degree or higher.[89] The median household income of Bexar residents is approximately $50,000, compared to $51,900 for all Texas residents.[90] However, those employed in the IA industry typically earn more than the average Bexar County resident.

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[81] "Cyber City USA," page 3, accessed September 29, 2014, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=8&cad=rja&uact=8&ved=0CE8QFjAH&url= http%3A%2F%2Fwww.alamoaog.org%2Flunch%2FSACAP.pptx&ei=LMAqVJ29BIKFyQS4koKwBg&usg=AFQjCNFNVe pUuANXSk3Sw9ocBvqFRDg0tQ&sig2=JpBFcPzbknGX-98Q_g431A&bvm=bv.76477589,d.cWc

[82] Ibid, page 5.

[83] Thomas, "Securing our Cyber Status."

[84] "Top 10 Universities for Cybersecurity," DSST.

[85] Melissa Repko, "SMU Cybersecurity Programs Trains Tomorrow's Data Defenders," *Dallas News,* September 08, 2014, Accessed September 30, 2014, http://www.dallasnews.com/news/education/headlines/20140908-smu-cybersecurity-program-trains-tomorrow-s-data-defenders.ece.

[86] "St. Mary's University unveils Cybersecurity master's degree," St. Mary's University, February 23, 2015, accessed September 8, 2015, https://www.stmarytx.edu/2015/st-marys-university-unveils-cybersecurity-masters-degree/.

[87] Repko, "SMU Cybersecurity Programs Trains Tomorrow's Data Defenders.".

[88] Jaikumar Vijayan, "IT Pros Rank University of Texas San Antonio Best School for Cybersecurity," *COMPUTERWORLD,* February 24, 2014, accessed September 30, 2014, http://www.computerworld.com/article/2487907/it-skills-training/it-pros-rank-university-of-texas-san-antonio-best-school-for-cybersecurity.html.

[89] "Bexar County, Texas QuickFacts," United States Census Bureau, last modified August 5, 2015, http://quickfacts.census.gov/qfd/states/48/48029.html.

[90] "Ibid.

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According to QCEW data and the IA industry as defined in Section 3.0, the average annual wage associated with the IA industry within Bexar County was approximately $84,000 in 2014—this was significantly higher than the countywide average annual wage of $45,676 for all industries in 2014.[91] In 2014, Bexar County has a total of 681 IA establishments employing nearly 6,000 individuals, and the average weekly wage for individuals in the IA industry approached $1,600.[92] The IA industry in Bexar County was not notably impacted by the 2008 recession and has seen growth on all counts since 2005, where Bexar County had a total of 327 IA establishments employing approximately 3,800 individuals, and the average weekly wage for individuals in the IA industry was approximately $2,300.[93]

5.1.3 Salt Lake County, Utah

With an ever-increasing number of cybersecurity jobs, Salt Lake City has evolved into Utah's technology hub.[94] The $1.5 billion Utah Data Center facility at Camp Williams in Bluffdale is tasked by the National Security Agency with aggregating data.[95] This will potentially increase computer and data processing jobs in the surrounding areas.[96] According to Governor Gary Herbert, Utah's "natural pool of STEM graduates from Utah universities, and [its] business-friendly policies make Utah an excellent place to do business."[97]

In 2011, New York-based ITT Electronic Systems expanded its Salt Lake City operations. The expansion is estimated to bring close to 3,000 new jobs to Utah during the fifteen-year project term.[98] Similarly, California-based FireEye planned to expand to Utah in 2013. The planned expansion would bring 250 new jobs, $152 million in wages, and more than $14 million in state tax revenue to Utah during the ten-year project term.[99] As of fall 2014, Utah Valley University began to offer a cybersecurity graduate certification with the hope of meeting demands for individuals in internet security technologies.[100]

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[91] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[92] Ibid.

[93] Ibid.

[94] "Utah is a Hotbed for Cyber Security Careers— Certified Ethical Hacker Certifications a Must Have," Quickcert, last modified November 04, 2013, http://blog.quickcert.com/utah-hotbed-cyber-security-careers/.

[95] Ibid.

[96] Jasen Lee, "Provo-Orem, Salt Lake City among best performers for business," January 24, 2014, accessed September 29, 2014, http://www.deseretnews.com/article/865594845/Provo-Orem-Salt-Lake-City-among-best-performers-for-business.html?pg=all.

[97] "Proofpoint and Utah Governor Celebrate the Cybersecurity Leader's Expanded Presence with Ribbon-Cutting Ceremony," Proofpoint, July 15, 2015, accessed September 8, 2015, https://www.proofpoint.com/us/proofpoint-and-utah-governor-celebrate-cybersecurity-leader%E2%80%99s-expanded-presence-ribbon-cutting.

[98] Jasen Lee, "ITT expansion to create over 2,700 jobs in Utah," June 9, 2011, accessed September 29, 2014, http://www.deseretnews.com/article/705374254/ITT-expansion-to-create-over-2700-jobs-in-Utah.html?pg=all.

[99] Jasen Lee, "Cyber security firm to bring 250 jobs to Utah," KSL, March 4, 2013, accessed September 29, 2014. http://www.ksl.com/?sid=24292423.

[100] Melinda Colton, "Regents Approve New Cybersecurity Graduate Certificate At UVU," Utah Valley University, July 22, 2014, accessed September 29, 2014, http://blogs.uvu.edu/newsroom/2014/07/22/regents-approve-new-cybersecurity-certificate-at-uvu/.

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In 2014, Salt Lake County was home to more than 37 percent of Utah's total population, with an estimated population of approximately 1.1 million. According to the United States Census Bureau, Salt Lake County residents were on par with the average Utah resident in terms of education, but generally earned a slightly higher median household income. For individuals 25 years and older, 89.0 percent hold at least a high school diploma while 31.0 percent hold a bachelor's degree or higher—comparatively, 89.0 percent of Utah residents aged 25 years or older have at least a high school diploma, while 30.3 percent hold a bachelor's degree or higher.[101] The median household income of Salt Lake residents is approximately $61,000, compared to $58,821 for all Utah residents.[102] Those employed in the IA industry typically earn more than the average Salt Lake County resident.

According to QCEW data and the IA industry as defined in Section 3.0, the average annual wage associated with the IA industry within Salt Lake County was approximately $92,000 in 2014—this was significantly higher than the countywide average annual wage of $48,290 for all industries in 2014.[103] In 2014, Salt Lake County has a total of 1,600 IA establishments employing nearly 11,000 individuals, and the average weekly wage for individuals in the IA industry approached $1,800.[104] The IA industry in Salt Lake County saw reduction in employment of nearly 1,300 individuals between 2008 and 2010 (likely due to the 2008 recession), but has since recovered. The IA industry in Salt Lake County has seen growth on all counts since 2005 where Salt Lake County has a total of 900 IA establishments employing approximately 7,200 individuals, and the average weekly wage for individuals in the IA industry was approximately $1,300.[105]

5.1.4   Fairfax County, Virginia

Due to its proximity to Washington, D.C., Fairfax County has access to vast resources and clients and is home to a multitude of IA and cybersecurity government contracting firms.[106] When compared to the national average, Virginia has four times the number of information security analysts—something Fairfax County is capitalizing on with the more than 300 cyber-related technology firms present in the county. [107] [108]

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[101] "Salt Lake County, Utah QuickFacts," United States Census Bureau, last modified August 5, 2015, http://quickfacts.census.gov/qfd/states/49/49035.html.

[102] Ibid.

[103] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[104] Ibid.

[105] Ibid.

[106] "Industry Spotlight: Cyber Security," Fairfax County Economic Development Authority, accessed September 30, 2014, http://www.fairfaxcountyeda.org/industry-spotlight-cyber-security.

[107] "Industry Profile: Cybersecurity," page1, Fairfax County Economic Development Authority, July 2014, September 29, 2014, http://www.fairfaxcountyeda.org/sites/default/files/pdf/cybersecurity.pdf .

[108] "Industry Spotlight: Cyber Security," Fairfax County Economic Development Authority.

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In 2011, Falls Church-based General Dynamics Corporation was ranked fifth on Washington Technology's Top 100 list of largest federal government contractors. The firm is under a five-year contract with the United States Army and stands to earn $64.5 million for providing security and communications support.[109] George Mason University is promoted as one of the top ten universities for cyber security. The Center for Secure Information Systems at George Mason is sponsored by both government and private sector companies.[110] Meanwhile, through the Department of Homeland Security and the National Security Agency, Northern Virginia Community College has received the designation of National Center of Academic Excellence in Information Assurance 2-Year Education (CAE2Y).[111]

In August 2014, Governor Terry McAuliffe "set a hard timeline for the Virginia Information Technologies Agency (VITA) to fully review the state's cybersecurity risk management stance…the agency is expected to prioritize risks and determine the sensitivity of the state data systems."[112]

In 2014, Fairfax County's estimated population reached approximately 1.1 million, nearly 14 percent of Virginia's total population. According to the United States Census Bureau, Fairfax County residents are more likely to hold a bachelor's degree or higher and earned a higher median household income. For individuals 25 years and older, 91.8 percent hold at least a high school diploma while 58.6 percent hold a bachelor's degree or higher—comparatively, 87.5 percent of Virginia residents aged 25 years or older have at least a high school diploma, while 35.2 percent hold a bachelor's degree or higher.[113] The median household income of Fairfax County residents is approximately $110,000, compared to $63,907 for all Virginia residents.[114] Those employed in the IA industry typically earn more than the average Fairfax County resident.

According to QCEW data and the IA industry as defined in Section 3.0, the average annual wage associated with the IA industry within Fairfax County was approximately $94,000 in 2014—this was significantly higher than the countywide average annual wage of $78,839 for all industries in 2014.[115] In 2014, Fairfax County has approximately 350 IA establishments employing more than 69,000 individuals, and the average weekly wage for individuals in the IA industry surpassed $3,000.[116] The IA industry in Fairfax County was not notably impacted by the 2008

[109] David Hubler, "General Dynamics provides cyber, communications support to Army," Washington Technology, April 12, 2012, accessed September 29, 2014, http://washingtontechnology.com/articles/2012/04/12/gdit-army-award.aspx.

[110] "Top 10 Universities for Cybersecurity," DSST.

[111] "Industry Profile: Cybersecurity," page 1.

[112] Eidam, "California, Virginia Take Steps to Bolster Cybersecurity Stance."

[113] "Fairfax County, Virginia QuickFacts," United States Census Bureau, last modified August 5, 2015, http://quickfacts.census.gov/qfd/states/51/51059.html.

[114] Ibid.

[115] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[116] Ibid.

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recession and has seen growth on all counts since 2005, where Fairfax County had approximately 230 IA establishments employing approximately 59,000 individuals, and the average weekly wage for individuals in the IA industry was approximately $1,300.[117]

5.2 Multi-State Comparison of the IA Industry

Using QCEW data on establishments, employment, and average weekly wages, Figures 3 through 5 show the growth in the total IA industry, as defined in Section 3.0, from 2005 to 2014 within each state featured in this comparison. The findings in this section are based on RESI's analysis of QCEW data.[118] It should be noted that, due to disclosure restrictions, not all employment nor wage data are available for the areas compared within this section. St. Mary's County, Bexar County, and Fairfax County all have non-disclosed employment and weekly wages data for some, but not all, of the selected industry components.[119]

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[117] "Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

[118] RESI collected QCEW data (through NAICS codes) on the number of establishments in the IA industry across multiple states from 2005 to 2014. RESI added the NAICS code information per year to derive the information reported in this section.

[119] According to the BLS, data may be suppressed for a variety of reasons: to protect the identity, or identifiable information, of cooperating employers; when data are provided by or are substantially attributable to a single large employer; and for otherwise disclosable data that may be used to derive sensitive information from another industry or area.

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Figure 2: IA Establishments across Comparison Regions

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
St. Mary's County, MD	54	61	64	67	76	82	85	80	78	85	73
San Diego County, CA	1,554	1,718	1,685	1,679	1,741	1,690	1,679	1,706	1,760	1,857	1,707
Bexar County, TX	327	355	415	448	492	528	590	629	658	681	512
Salt Lake County, UT	927	1,052	1,154	1,157	1,179	1,187	1,223	1,342	1,466	1,568	1,226
Fairfax County, VA	228	217	235	273	297	319	335	343	350	353	295

Sources: BLS QCEW, RESI

Since 2005, St. Mary's County has seen a 57 percent increase in the number of IA-related establishments. This is significantly higher than the growth in overall establishments for both St. Mary's County and Maryland—which were 7 percent and 4 percent, respectively.[120] At 108 percent, Bexar County saw the largest increase, while Fairfax County, at less than 1 percent, saw the smallest increase.

Figure 3: IA Employment across Comparison Regions, in thousands

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
St. Mary's County, MD	1.8	1.8	1.9	2.1	2.3	1.9	2.1	2.1	1.9	2.0	2.0
San Diego County, CA	14.4	14.9	15.9	16.2	16.5	17.1	17.4	17.4	18.0	18.3	16.6
Bexar County, TX	3.8	3.8	3.4	3.5	4.2	4.6	5.0	5.4	5.5	5.9	4.5
Salt Lake County, UT	7.2	8.6	9.3	9.7	8.9	8.5	9.0	9.6	10.3	10.9	9.2
Fairfax County, VA	59.1	62.8	67.0	70.2	71.5	71.9	74.7	74.6	73.5	69.5	69.5

Sources: BLS QCEW, RESI

Since 2005, St. Mary's County has seen a 9 percent increase in the number of employees in IA-related establishments. At 54 percent, Bexar County saw the largest increase, while Fairfax County saw close to a 0 percent increase. At an average of 27 employees per establishment, St. Mary's County has the second largest concentration of employees per establishment. Only Fairfax County, with

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[120] Quarterly Census of Employment and Wages (QCEW)," U.S. Bureau of Labor Statistics.

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240 employees per establishment, has a higher concentration. The remaining counties, San Diego, Bexar, and Salt Lake, have much lower concentrations of employees per establishment at 10 or fewer employees per establishment each.

Figure 4: IA Average Weekly Wages across Comparison Regions, in thousands

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
St. Mary's County, MD	$1.3	$1.4	$1.5	$1.5	$1.6	$1.6	$1.8	$1.9	$1.8	$1.9	$1.6
San Diego County, CA	$1.4	$1.4	$1.5	$1.6	$1.6	$1.7	$1.8	$1.9	$2.0	$2.0	$1.7
Bexar County, TX	$2.3	$2.4	$2.4	$2.5	$2.5	$2.5	$1.5	$1.5	$1.6	$1.6	$2.1
Salt Lake County, UT	$1.3	$1.3	$1.4	$1.4	$1.4	$1.5	$1.5	$1.6	$1.6	$1.8	$1.5
Fairfax County, VA	$1.3	$1.3	$1.4	$1.4	$1.4	$1.5	$2.9	$3.2	$3.3	$3.1	$2.1

Sources: BLS QCEW, RESI

Since 2005, St. Mary's County has seen a 40 percent increase in the average weekly wages in IA-related establishments. At 41 percent, San Diego County saw the largest increase. Bexar County saw the only decrease, at 30 percent—this decline is likely due to the closing of a federal government facility. Given that St. Mary's County, Bexar County, and Fairfax County all have non-disclosed weekly wages data at the six-digit NAICS code level, average weekly wages could be higher than shown here.

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6.0 Economic Impact Methodology

The previous section focused on the comparative analysis of St. Mary's County's IA industry with other counties nationwide from 2005 to 2014. This section covers data solely for St. Mary's County for 2015.[121] RESI used the data presented in Section 5.0 regarding jobs, wages, and establishments to establish a series of inputs for RESI's REMI PI+ input/output model. This model enumerates jobs, output, and wages for a specific region at the direct, indirect, and induced levels. Direct jobs in this scenario would be all jobs associated with the IA industry as defined in Section 5.0 for St. Mary's County. Indirect and induced economic activity is a result of these direct jobs being in St. Mary's County. Section 6.1 explains the REMI PI+ model in more detail. Section 6.2 details RESI's modeling assumptions and inputs. Finally, Section 6.3 presents the results from the REMI PI+ model and RESI's analysis.

6.1 REMI PI+ Model Overview

To quantify the economic impacts of the IA industry in St. Mary's County, RESI used the REMI PI+ model version 1.7. This model enumerates the economic and fiscal impacts of each dollar earned and spent by the following:

- Jobs relating to the economic events;
- Other supporting vendors (business services, retail, etc.);
- Each dollar spent by these vendors on other firms; and
- Each dollar spent by the households of the event's employees, other vendors' employees, and other businesses' employees.

The REMI PI+ model is dynamic, as it allows for price and wage effects to filter into the impacts reported by the model. Another benefit of the model compared to traditional static models, such as IMPLAN, is the regional constraint is built in to account for limited resources over time. Economic impacts as a result of the economic activity inputted into the REMI PI+ model and are often reported by three distinct types: direct, indirect, and induced impacts. Direct economic effects are those effects generated by an economic event that generates jobs, output, and wages within an economy and is directly related to the economic event. Indirect economic effects are those economic impacts associated with related industries to the direct industry impacted by the economic event. This may include vendors purchasing goods and services from other firms. Finally, indirect economic effects are those that result from households increasing their purchases at local businesses. .

Consider the following example. A new firm opens in a region dedicated to custom computer programming services (NAICS 541511) in St. Mary's County. The firm directly employs 100 workers. These 100 jobs are considered direct economic effects. To meet its demand, the firm purchases supplies, both from outside the region as well as from local suppliers, which leads to

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[121] Using 2014 data, and Maryland's 2015 statewide estimates, RESI projected the IA industry in St. Mary's County as of 2015 to determine the economic impacts to date.

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an increase in business for local firms, thereby hypothetically creating jobs for another 100 workers. These additional 100 workers as a result of the increased demand for supplies from the custom computer programming services are considered indirect economic effects. The workers at the custom computer programming services firm and at local indirect suppliers spend their income mostly in the St. Mary's region, hypothetically creating jobs for another 50 workers. These 50 new jobs are considered an induced economic effect as a result of the increased household spending within St. Mary's County. The direct, indirect, and induced effects add up to 250 jobs created from the original 100 jobs. Thus, in terms of jobs, the total economic impact of the custom computer programming services firm opening in St. Mary's County in our example is 250.

6.2   Inputs and Assumptions

To determine the economic and fiscal impacts on St. Mary's County associated with the IA industry in 2015, RESI used QCEW data to determine the level of current employment within the IA industry for Maryland by NAICS. This information was then extrapolated using RESI's REMI PI+ forecast for the four-digit sectors for 2015 for this industry. Finally, using the share of the industry in Maryland held by St. Mary's County, RESI applied the share against the 2015 estimates for the state to estimate the potential size of St. Mary's County IA Industry in 2015.

As noted in Section 5.0, some sectors in St. Mary's County are non-disclosed for various reasons. In cases where information on employment and wages was not disclosed, RESI assumed an estimated share of the industry in terms of the state's overall employment and wages based on the number of establishments within the County. In Section 5.0, Figure 3 reports an approximate 2,000 jobs in the IA industry as of 2014 based on QCEW data. There were at least two industries that did not report data for disclosure reasons. Through the extrapolation method described here, RESI estimated that by 2015 this estimate increases to approximately 2,033 jobs in St. Mary's County in the IA industry. The 63 additional jobs are assumed as the employment that was non-disclosed for specific reasons and the growth within the industry from 2014 to 2015 based on Maryland's forecasted growth for the industry. For more information on how RESI derived this estimate, please see the methodology in Appendix A.

6.3   Economic and Fiscal Impacts

Using the inputs from the QCEW data and the extrapolation method explained in Section 6.2, RESI used the potential jobs across each sector of the IA industry as the inputs for the REMI PI+ model. The results are reported in Figure 5.

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Figure 5: Total Economic Impacts—IA Industry in St. Mary's County, 2015

Impact	Direct	Indirect/Induced	Total
Jobs	2,033	1,763	3,797
Output	$321,707,300	$206,209,300	$527,916,600
Wages	$142,942,508	$92,341,912	$235,284,420

Sources: REMI PI+, RESI

As noted previously, the estimate of direct jobs associated with the IA industry as reported in Figure 5 differs slightly from the reported QCEW data in Section 5.0 due the extrapolation method used to determine potential jobs from industries that were non-disclosed. The difference here is roughly 63 direct jobs in 2015. The total results reported in Figure 5 estimate that the IA industry contributes approximately 3,797 jobs, $527.9 million in output, and nearly $235.3 million in wages. Of the jobs created by the IA industry, more than 2,000 jobs are direct, and nearly 1,760 jobs are indirect and induced jobs. Of the total wages supported by the industry in St. Mary's County, nearly $142.9 million are direct, and $92.3 million are indirect and induced wages. The average annual wage associated with the direct jobs is approximately $70,311, while indirect and induced average annual wages were approximately $52,378 in 2015.

When analyzing the economic impacts in reference to the county as a whole, according to RESI's extrapolated forecast from the QCEW data and historical growth rates, in 2015 St. Mary's County's total employment will consist of approximately 43,045 jobs.[122] From Figure 5, RESI estimated that approximately 2,033 of these jobs are directly related to the IA industry and an additional 1,763 are indirect and induced jobs as a result of this industry in St. Mary's County. This means that the total 3,797 jobs as reported in Figure 5 account for nearly 8.8 percent of the total jobs in 2015 in St. Mary's County.

The average annual wage is estimated to be approximately $64,855 per year in St. Mary's County, according to RESI's forecast. Direct jobs in the IA industry are roughly $5,456 higher than the county average, although indirect and induced wages benefit as well from the higher wages of those in the IA industry, earning $12,477 higher on average than the average annual wage forecast. The difference in the wages for indirect and induced jobs is mainly driven by the indirect potential employment for individuals within the *Professional, Scientific, and Technical Services* sector related to the IA industry's indirect demand to support business functions.

Using the economic impacts, RESI calculated the total fiscal impacts associated with the IA industry in St. Mary's County. The fiscal impacts associated with the IA industry are reported in Figure 6.

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[122] "St. Mary's County, All Industries, Total Covered Employment, Employees" QCEW, accessed Sept. 11, 2015. RESI took a five year moving average of growth and applied to annual 2014 estimates to determine potential 2015 employment.

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Figure 6: Total Fiscal Impacts—IA Industry in St. Mary's County, 2015

Impact Type	Total
Property	$3,147,702
Income	$2,212,517
Sales	$2,922,075
Payroll	$58,855
Other[123]	$1,928,767
Total	**$10,269,916**

Sources: REMI PI+, RESI

As reported in Figure 6, the total fiscal impacts associated with the IA industry in St. Mary's County contributes $10.3 million annually to state and local tax revenues. Of those revenues, approximately $3.1 million are associated with property taxes, $2.2 million with income taxes, $2.9 million with sales taxes, $0.06 million with payroll taxes, and $1.9 million with other tax revenues. Of the total property tax revenues, approximately $2.8 million are local tax revenues and $0.4 million are state tax revenues. Furthermore, local income tax revenues supported by IA are approximately $0.9 million, and approximately $1.4 million are collected by the State.

7.0 IA Inputs

There are a multitude of input industries for the worldwide IA industry. These support industries provide the expertise and materials necessary to the IA industry. Examples of such vital support industries can be found in Figure 7.

Figure 7: IA Input Industries

Code	Description	Function
334111	Electronic Computer Manufacturing	Establishments primarily engaged in manufacturing and/or assembling electronic computers, such as mainframes, personal computers, workstations, laptops, and computer servers.
334112	Computer Storage Device Manufacturing	Establishments primarily engaged in manufacturing computer storage devices that allow the storage and retrieval of data from a phase change, magnetic, optical, or magnetic/optical media.
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	Establishments primarily engaged in manufacturing computer terminals and other computer peripheral equipment (except storage devices).

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[123] Other taxes include but are not limited to revenues from licensing fees and permits.

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Code	Description	Function
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	Establishments primarily engaged in loading components onto printed circuit boards or who manufacture and ship loaded printed circuit boards.
334419	Other Electronic Component Manufacturing	Establishments primarily engaged in manufacturing electronic components (except bare printed circuit boards; semiconductors and related devices; electronic capacitors; electronic resistors; coils, transformers and other inductors; connectors; and loaded printed circuit boards).
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	Establishments primarily engaged in merchant wholesaling computer hardware or software products and providing supporting services, such as customized assembly of personal computers
443142	Electronics Stores	Establishments primarily engaged in selling computer hardware or software products and systems from retail-like locations, and providing supporting services, such as customized assembly of personal computers/
511210	Software Publishers	Establishments primarily engaged in publishing packaged software.
518210	Data Processing, Hosting, and Related Services	Establishments primarily engaged in providing computer data processing services at their own facility for others.
541513	Computer Facilities Management Services	Establishments primarily engaged in providing on-site management and operation of clients' computer systems and/or data processing facilities.
611310	Colleges, Universities, and Professional Schools	Establishments primarily engaged in furnishing academic courses and granting degrees at baccalaureate or graduate levels.
611420	Computer Training	Establishments primarily engaged in conducting computer training (except computer repair), such as computer programming, software packages, computerized business systems, computer electronics technology, computer operations, and local area network management.
928110	National Security	Government establishments of the Armed Forces, including the National Guard, primarily engaged in national security and related activities.

Sources: United State Census Bureau, RESI

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Unlike the industries outlined in Section 3.0, these industries act as suppliers to the IA industry. For example, these industries provide the necessary training required to perform IA tasks but do not involve completing the tasks themselves. Additionally, while these industries support the IA industry, they also serve other purposes. For example the *Colleges, Universities, and Professional Schools* industry also supports a large variety of other industries. Therefore, these industries were excluded from the analysis.

8.0   Conclusion

The increased use of advanced technology puts even more personal information at risk than ever for governments, businesses, and individuals alike. St. Mary's County has the means and motive to be a leader in IA advancement. The county is home to a multitude of technological companies, including defense contractors and educational programs, and is a prime location for IA advancement. The county's skilled and educated population, coupled with the numerous resident technological companies and the existence of Naval Air Station Patuxent River, provides vast opportunities for IA advancement among all related industries.

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Appendix A—Methodology and Assumptions

To assess the potential economic and fiscal impacts from the IA industry on St. Mary's County, RESI used Quarterly Census of Employment and Wages (QCEW) data for the annual average of 2014. Some sectors, as noted in Section 5.0, did not have disclosed data. To estimate the potential impacts associated with these sectors in St. Mary's County, RESI used the following methodology.

First, RESI pulled state-level data associated with the following sectors for the analysis, as reported in Figure 8.

Figure 8: IA Industry for State of Maryland, Average Annual 2014

NAICS	Number of Employees	Total Wages Paid	Number of Establishments
541511	22,784	$2,782,259,000	2,760
541512	41,751	$4,413,846,000	5,042
541513	711	$59,569,000	97
541519	3,042	$291,071,000	374
54151	68,288	$7,546,746,000	8,274

Sources: BLS QCEW, RESI

As reported in Figure 8, RESI estimated the number of employees per establishment and average wage per employee. To calculate this information, RESI used the following formulas:

$$Average\ Employee\ per\ Establishment\ in\ MD = \frac{Total\ Number\ of\ Employees\ by\ NAICS\ Code}{Total\ Number\ of\ Establishments\ by\ NAICS\ Code}$$

$$Average\ Wage\ per\ Employee\ in\ MD = \frac{Total\ Wages\ Paid\ by\ NAICS\ Code}{Total\ Number\ of\ Employees\ by\ NAICS\ Code}$$

Using the above formulas with the QCEW data in Figure 8, RESI found that the average salary in the state ranged from $83,782 to $122,115, with the highest average employee pay occurring in NAICS 541511 (Custom computer programming services). RESI then collected QCEW data by NAICS code for each IA-related industry in St. Mary's County. Figure 9 reports the results.

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Figure 9: IA Industry for St. Mary's County, Average Annual 2014

NAICS	Number of Employees	Total Wages Paid	Number of Establishments
541511	372	$42,786,000	23
541512	1,402	$133,825,000	53
541513	ND	ND	3
541519	ND	ND	6
54151	1,970	$193,612,000	84

Sources: BLS QCEW, RESI

As reported in Figure 9, RESI found that the total number of employees and total number of wages for NAICS 541513 and 541519 were not disclosed for St. Mary's County. However, RESI determined the number of establishments for these NAICS codes in St. Mary's County from QCEW. Using the aforementioned formulas to determine the average wage per employee in Maryland and the average employees per establishment in Maryland, RESI estimated the potential number of employees and wages for NAICS 541513 and 541519. An updated version of Figure 9 is provided in Figure 10.

Figure 10: IA Industry for St. Mary's County, Average Annual 2014

NAICS	Number of Employees	Total Wages Paid	Number of Establishments
541511	372	$42,786,000	23
541512	1,402	$133,825,000	53
541513	22	$1,842,340	3
541519	49	$4,669,588	6
54151	1,970	$193,612,000	84

Sources: BLS QCEW, RESI

According to Figure 10, total wages paid in the IA industry range from $1.8 million to $133.8 million. Total establishments in St. Mary's County associated with the IA industry range from 3 to 53, with total employment ranging from approximately 22 to 1,402. Using the information provided in Figure 9, RESI inputted employment by four-digit NAICS code (54151) into the REMI PI+ input/output model to estimate the total economic and fiscal impacts.

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